

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-13. (canceled)

14. (previously presented) A packet processing apparatus for converting packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory for storing a header portion of the packet data, which is written by a lower layer processing portion at a time of the packet data reception, used in a process of a higher layer processing portion for higher layer processing operations, and read by the lower layer processing portion at a time of the packet data transmission, wherein the lower layer processing portion reads the header portion from the shared memory, and

wherein the lower layer processing portion and the higher layer processing portion access a same memory space of said shared memory through physically different memory buses.

15. (previously presented) A packet processing apparatus for converting packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory as a multi-port memory for storing a header portion of the packet data, which is written by a layer 2 processing portion as a data link layer at a time of the packet data reception, used in a process of a layer 3 processing portion as a network layer for a packet routing operation, and read by the layer 2 processing portion at a time of the packet data transmission, wherein the layer 2 processing portion reads the header portion from the shared memory, and

wherein the layer 2 processing portion and the layer 3 processing portion access the same memory space of said shared memory through physically different memory buses.

16. (previously presented) A packet processing apparatus for converting packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory for storing a header portion of the packet data, which is used in a process of a higher layer processing portion for higher layer processing operations; and

a lower layer processing portion, which writes at least said user information portion and said header portion of the packet data into said packet memory and said shared memory respectively at a time of the packet data reception, reads said

header portion of the packet data rewritten by the higher layer processing portion, from said shared memory, and combines said header portion read from said shared memory with said user information portion stored in said packet memory, as a packet to be transmitted.

17. (previously presented) The packet processing apparatus as set forth in claim 16, wherein said lower layer processing portion is a layer 2 processing portion as a data link layer and said higher layer processing portion is a layer 3 processing portion as a network layer.

18. (previously presented) A packet processing apparatus for converting packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory for storing a header portion of the packet data, which is used in a process of a layer 3 processing portion for a packet routing higher operation; and

a layer 2 reception processing portion, which writes at least said user information portion and said header portion of the packet data into said packet memory and said shared memory, respectively at a time of the packet data reception; and

a layer 2 transmission processing portion, which reads said header portion of the packet data rewritten by the layer 3 processing portion, from said shared memory,

and combines said header portion read from said shared memory with said user information portion stored in said packet memory, as a packet to be transmitted.

19. (currently amended) A packet processing method for exchanging packet data through a plurality of layers, comprising ~~the steps of:~~

storing at least a user information portion of the packet data into a packet memory; and

storing a header portion of the packet data into a shared memory,

wherein said header portion is written by a lower layer processing portion at a time of the packet data reception, used in a process of a higher layer processing portion for higher layer processing operations, and read by the lower layer processing portion at a time of the packet data transmission, wherein the lower layer processing portion and the higher layer processing portion access the same memory space of said shared memory through physically different memory buses.

20. (previously presented) A packet processing method for exchanging packet data through a plurality of layers, comprising:

storing at least a user information portion of the packet data to a packet memory; and

storing a header portion of the packet data to a shared memory as a multi-port memory,

wherein said header portion is written by a layer 2 processing portion as a

data link layer at a time of the packet data reception,

used in a process of a layer 3 processing portion as a network layer for a packet routing operation, and

read by the layer 2 processing portion at a time of the packet data transmission, wherein the layer 2 processing portion and the layer 3 processing portion access the same memory space of said shared memory through physically different memory buses.

21. (previously presented) A packet processing method for exchanging packet data through a plurality of layers, comprising:

storing at least a user information portion of the packet data into a packet memory;

storing a header portion of the packet data into a shared memory, said header portion being used in a process of a higher layer processing portion for higher layer processing operations;

at a lower layer processing portion,

writing at least said user information portion and said header portion of the packet data into said packet memory and said shared memory, respectively at a time of the packet data reception;

at a layer 2 transmission processing portion,

reading said header portion of the packet data rewritten by the higher layer processing portion, from said shared memory; and

combining said header portion read from said shared memory with said user information portion stored in said packet memory, as a packet to be transmitted.

22. (previously presented) The packet processing method as set forth in claim 21, wherein said lower layer processing portion is a layer 2 processing portion as a data link layer and said higher layer processing portion is a layer 3 processing portion as a network layer.

23. (previously presented) A packet processing method for exchanging packet data through a plurality of layers, comprising:

storing at least a user information portion of the packet data into a packet memory;

storing a header portion of the packet data into a shared memory, said header portion being used in a process of a layer 3 processing portion for a packet routing higher operation;

at a layer 2 reception processing portion,

writing at least said user information portion and said header portion of the packet data into said packet memory and said shared memory, respectively at a time of the packet data reception;

reading said header portion of the packet data rewritten by the layer 3 processing portion, from said shared memory, and

combining said header portion read from said shared memory with said

user information portion stored in said packet memory, as a packet to be transmitted.

24. (currently amended) A packet processing method for exchanging packet data through a plurality of layers recommended by Open System Interconnection reference model, comprising ~~the steps of~~:

storing the entire packet into a packet memory; and

storing part of each packet of the packet data used in processes of a layer 2 processing portion and a layer 3 processing portion into a multi-port shared memory, the layer 2 processing portion and the layer 3 processing portion accessing the same memory space of the multi-port shared memory,

wherein a pipeline processing system is used so that the layer 2 processing portion and the layer 3 processing portion access the shared memory without an interference.

25. (previously presented) A packet exchange for exchanging packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory for storing a header portion of the packet data, which is written by a lower layer processing portion at a time of the packet data reception, used in a process of a higher layer processing portion for higher layer processing operations, and read by the lower layer processing portion at a time of the packet data transmission,

wherein the lower layer processing portion reads the header portion from the shared memory, and

wherein the lower layer processing portion and the higher layer processing portion access a same memory space of said shared memory through physically different memory buses.

26. (previously presented) A packet exchange for exchanging for exchanging packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory as a multi-port memory for storing a header portion of the packet data, which is written by a layer 2 processing portion as a data link layer at a time of the packet data reception, used in a process of a layer 3 processing portion as a network layer for a packet routing operation, and read by the layer 2 processing portion at a time of the packet data transmission, wherein the layer 2 processing portion reads the header portion from the shared memory, and

wherein the layer 2 processing portion and the layer 3 processing portion access the same memory space of said shared memory through physically different memory buses.

27. (previously presented) A packet exchange for exchanging packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory for storing a header portion of the packet data, which is used in a process of a higher layer processing portion for higher layer processing operations; and

a lower layer processing portion, which writes at least said user information portion and said header portion of the packet data into said packet memory and said shared memory, respectively at a time of the packet data reception, reads said header portion of the packet data rewritten by the higher layer processing portion, from said shared memory, and combines said header portion read from said shared memory with said user information portion stored in said packet memory, as a packet to be transmitted.

28. (previously presented) The packet exchange as set forth in claim 27, wherein said lower layer processing portion is a layer 2 processing portion as a data link layer and said higher layer processing portion is a layer 3 processing portion as a network layer.

29. (previously presented) A packet exchange for exchanging packet data through a plurality of layers, comprising:

a packet memory for storing at least a user information portion of the packet data; and

a shared memory for storing a header portion of the packet data, which is used in a process of a layer 3 processing portion for a packet routing higher operation; and

a layer 2 reception processing portion, which writes at least said user information portion and said header portion of the packet data into said packet memory and said shared memory, respectively at a time of the packet data reception; and

a layer 2 transmission processing portion, which reads said header portion of the packet data rewritten by the layer 3 processing portion, from said shared memory, and combines said header portion read from said shared memory with said user information portion stored in said packet memory, as a packet to be transmitted.

30. (previously presented) A packet exchange for exchanging packet data through a plurality of layers recommended by Open System Interconnection reference model, comprising:

a layer 2 reception processing portion for receiving a packet, storing the received packet to a packet memory, and storing a header portion of the received packet into a shared memory;

a layer 3 processing portion for receiving the header portion, executing a network process corresponding to the header portion, updating the header portion when necessary, and storing the updated header portion into the same address of said shared memory; and

a layer 2 transmission processing portion for combining the updated

header portion received from said layer 3 processing portion and stored in said shared memory and packet information stored in said packet memory and transmitting the resultant data as a packet,

wherein said layer 2 transmission processing portion combines data updated by said layer 3 processing portion and stored in said shared memory and packet data stored in said packet memory, transmits the combined data, converts a packet format into a format of layer 1, and when layer 3 is an IP (Internet Protocol) layer, converts an IP V4 (Version 4) packet into an IF V6 (Version 6) packet or vice versa.

31. (previously presented) A packet exchange for exchanging packet data through a plurality of layers recommended by Open System Interconnection reference model, comprising:

a layer 2 reception processing portion for receiving a packet, storing the received packet to a packet memory, and storing a header portion of the received packet into a shared memory;

a layer 3 processing portion for receiving the header portion, executing a network process corresponding to the header portion, updating the header portion when necessary, and storing the updated header portion into the same address of said shared memory; and

a layer 2 transmission processing portion for combining the updated header portion received from said layer 3 processing portion and stored in said shared memory and packet information stored in said packet memory and transmitting the

resultant data as a packet,

wherein said layer 2 transmission processing portion combines data updated by said layer 3 processing portion and stored in said shared memory and packet data stored in said packet memory by said layer 2 reception processing portion, and when layer 3 is an IP (Internet Protocol) layer, performs an IP V6 tunneling process for an IP V4 packet, an IP V4 tunneling process for an IP V6 packet, or an IP V4 tunneling process for an IP V4 packet.

32. (previously presented) A packet exchange for exchanging packet data through a plurality of layers recommended by Open System Interconnection reference model, comprising:

a packet memory for storing the entire packet; and

a multi-port shared memory for storing part of each packet of the packet data used in processes of a layer 2 processing portion as a data link layer and a layer 3 processing portion as a network layer of the plurality of layers, the layer 2 processing portion and the layer 3 processing portion accessing the same memory space of said multi-port shared memory, and

a processor, connected to said layer 2 processing portion and said layer 3 processing portion, for executing a process of a layer higher than layer 3.

33. (previously presented) A packet processing apparatus for exchanging packet data through a plurality of layers, comprising:

a packet memory for storing the entire packet; and

a shared memory as a multi-port memory for storing part of each packet of the packet data used in processes of a layer 2 processing portion as a data link layer and a layer 3 processing portion as a network layer, the layer 2 processing portion and the layer 3 processing portion accessing the same memory space of said shared memory, wherein the layer 2 and 3 are recommended by Open System Interconnection reference model, and

a layer 2 reception processing portion for storing only a field necessary for layer 3 or a higher layer to said packet memory and said shared memory.

34. (previously presented) A packet processing apparatus for converting packet data through a plurality of layers, comprising:

a packet memory for storing the entire packet; and

a shared memory for storing part of each packet of the packet data used in processes of a lower layer processing portion and a higher layer processing portion, the lower layer processing portion and the higher layer processing portion accessing the same memory space of said shared memory through physically different memory buses, further comprising:

a layer 2 transmission processing portion for combining data stored in a plurality of packet memories and data stored in said shared memory and transmitting the resultant data as the packet, wherein the layer 2 is recommended by Open System Interconnection reference model.